

CLAIMS

We Claim:

1. A water-soluble film for packaging a non-liquid product, the film
5 comprising:
 - a hydrolyzed copolymer of vinyl acetate and methyl acrylate in a range of from about 30 to about 95 percent by weight;
 - modified starch in a range of from about 4 to about 30 percent by weight;
 - plasticizer in a range of from about 5 to about 30 percent by weight;
 - 10 lubricant/release agent in a range of from about 0.0 to about 1.5 percent by weight; and
 - surfactant in a range of from about 0.01 to about 1.5 percent by weight.
2. The composition of Claim 1, wherein the modified starch comprises hydroxyethyl modified starch.
- 15 3. The composition of Claim 2, wherein the amount of modified starch is about 4 to about 12 percent by weight.
4. The composition of Claim 1, wherein the water-soluble film, at a thickness of about 1.5 mil (about 0.038mm), dissolves in less than 60 seconds in water at a temperature of about 20 °C (about 68 °F) in accordance with MonoSol Test
20 Method MSTM 205.
5. The composition of Claim 1, wherein the hydrolyzed copolymer has a 4% solution viscosity in a range of about 5 to about 50 cps (about 0.005 to about 0.050 pascal seconds) at 20 °C (about 68 °F).
6. The composition of Claim 5, wherein the hydrolyzed copolymer has
25 a 4% solution viscosity in a range of about 8 to about 35 cps (about 0.008 to about 0.035 pascal seconds) at 20 °C (about 68 °F).
7. The composition of Claim 6, wherein the hydrolyzed copolymer has a 4% solution viscosity in a range of about 15 to about 25 cps (about 0.015 to about 0.025 pascal seconds) at 20 °C (about 68 °F).

8. The composition of Claim 1, wherein the copolymer film thickness is in a range of from about 0.1 to about 5.0 mils (about 0.0025 to about 0.127 mm).

9. The composition of Claim 8, wherein the copolymer film thickness is in a range of from about 0.5 to about 3.0 mils (about 0.013 to about 0.076 mm).

5 10. The composition of Claim 9, wherein the copolymer film thickness is in a range of from about 1.0 to about 2.0 mils (about 0.025 to about 0.050mm).

11. The composition of Claim 1, wherein the amount of plasticizer is in a range of from about 20 to about 30 percent by weight.

10 12. The composition of Claim 1, further comprising a bleaching agent for controlling color drift in the film.

13. The composition of Claim 12, wherein the bleaching agent is sodium metabisulfite.

14. The composition of Claim 13, wherein the amount of sodium metabisulfite is in a range of from about 0.12 to about 1.0 percent by weight.

15 15. The composition of Claim 14, wherein the amount of sodium metabisulfite is in a range of from about 0.4 to about 0.7 percent by weight.

16. The composition of Claim 1, wherein the hydrolyzed copolymer initially comprises an amount of from about 1 to about 12 mol percent gamma lactone units, and wherein after treatment with a caustic soda the hydrolyzed copolymer
20 comprises from about 1 to about 12 mol percent carboxylate groups and from about 0 to about 11 mol percent gamma lactone units.

17. The composition of Claim 1, wherein the hydrolyzed copolymer initially comprises an amount of from about 2 to about 8 mol percent gamma lactone units, and wherein after treatment with a caustic soda the hydrolyzed copolymer
25 comprises from about 2 to about 6 mol percent carboxylate groups and from about 0 to about 5 mol percent gamma lactone units.

18. The composition of Claim 1, wherein the hydrolyzed copolymer initially comprises an amount of from about 4 to about 6 mol percent gamma lactone

units, and wherein after treatment with a caustic soda the hydrolyzed copolymer comprises from about 3 to about 4 mol percent carboxylate groups and from about 1 to about 2 mol percent gamma lactone units.

19. A package for containing a non-liquid product, the package
5 comprising at least one compartment comprised of a water-soluble film according to claim 1.

20. The package of Claim 19, wherein the amount of modified starch is about 4 to about 12 percent by weight.

21. A unit dose of a non-liquid agent comprising:
10 a package according to claim 19, and
a non-liquid agent contained within the package.

22. The unit dose of Claim 21, wherein the amount of modified starch is about 4 to about 12 percent by weight.

23. A method for preparing a water-soluble copolymer film for
15 packaging of a non-liquid product, the method comprising the steps of:
copolymerizing vinyl acetate and methyl acrylate to form a copolymer;
hydrolyzing the vinyl acetate-methyl acrylate copolymer to form a vinyl
alcohol-gamma lactone copolymer having a 4% solution viscosity in a range of from
about 5 to about 50 cps at 20 °C;
20 slurrying the hydrolyzed polymer with water;
adding modified starch to the copolymer-water slurry in an amount of from
about 4.0 to about 25.0 percent by weight;
heating the hydrolyzed copolymer and starch slurry to form a solution;
treating the solution with caustic soda to create a solution of a copolymer
25 having from about 1 to about 12 mol percent carboxylate groups, from about 0 to about
11 mol percent gamma lactone units, and from about 88 to about 99 mol percent vinyl
alcohol units; and
casting the hot copolymer solution on a suitable surface to create a film having
a thickness in a range of from about 0.1 to about 5.0 mils (about 0.0025 to about 0.127
30 mm).

24. The method of Claim 23, further comprising the step of adding sodium metabisulfite in an amount greater than 0.12 percent by weight to prevent browning of the heated solution.

5 25. The method of Claim 24, wherein the amount of sodium metabisulfite is in a range of from about 0.4 to about 0.7 percent by weight.

26. The method of Claim 23, wherein the copolymer solution comprises from about 2 to about 6 mol percent carboxylate groups, from about 0 to about 5 mol percent gamma lactone units, and from about 92 to about 98 mol percent vinyl alcohol units.

10 27. The method of Claim 23, wherein the copolymer solution comprises from about 3 to about 4 mol percent carboxylate groups, from about 1 to about 2 mol percent gamma lactone units, and from about 94 to about 96 mol percent vinyl alcohol units.

15 28. The method of Claim 23, wherein the amount of modified starch used is about 4 to about 12 percent by weight.

29. The method of Claim 28, wherein the modified starch comprises hydroxyethyl modified starch.

30. The method of Claim 23, further comprising the step of forming the resulting film into a package for packaging a non-liquid product.

20 31. The method of Claim 28, wherein the water-soluble film at a thickness of about 1.5 mil (about 0.038 mm) dissolves in water at a temperature of about 20 °C (about 68 °F) in less than 60 seconds in accordance with MonoSol test method MSTM 205.

25 32. The method of Claim 23, wherein the water-soluble film at a thickness of about 1.5 mil (about 0.038 mm) dissolves in water at a temperature of about 20 °C (about 68 °F) in less than 60 seconds in accordance with MonoSol test method MSTM 205.

33. A method for preparing a water-soluble copolymer film for packaging of a non-liquid product, the method comprising the steps of:

- providing a vinyl acetate-methyl acrylate copolymer;
- hydrolyzing the vinyl acetate-methyl acrylate copolymer to form a vinyl alcohol-gamma lactone copolymer having a 4% solution viscosity in a range of from about 5 to about 50 cps at 20 °C;
- 5 slurrying the hydrolyzed polymer with water;
- adding modified starch to the copolymer-water slurry in an amount of from about 4 to about 25.0 percent by weight;
- heating the vinyl alcohol-gamma lactone copolymer and starch to form a solution;
- 10 treating the solution with caustic soda to create a solution of a copolymer having from about 1 to about 12 mol percent carboxylate groups, from about 0 to about 11 mol percent gamma lactone units, and from about 88 to 99 mol percent vinyl alcohol units;
- casting the hot copolymer solution on a suitable surface to create a film having
- 15 a thickness in a range of from about 0.1 to about 5.0 mils (about 0.0025 to about 0.127mm).